THE RESHARPENING OF BEVEL-EDGED TOOLS FROM COASTAL SOUTHEAST QUEENSLAND

IAN J. McNIVEN

McNiven, I.J. 1991 08 01: The resharpening of bevel-edged tools from coastal southeast Queensland. *Memoirs of the Queensland Museum* **30**(3): 493–504. Brisbane. ISSN 0079-8835.

Bevel-edged tools are a distinctive Aboriginal stone tool type from coastal southeast Queensland. To date, most research on these tools has focused on their morphology and use, particularly in relation to the processing of the plant food staple bungwall fern. This paper investigates the dynamic use-life of these tools through an investigation of working edge maintenance and resharpening at two sites recently excavated at the mouth of the Maroochy River. ☐ *Bevel-edged tools, aboriginal tools, SE Queensland, coastal.*

Ian J. McNiven, Department of Archaeology La Trobe University Bundoora Victoria 3083, Australia; 24 November, 1989.

The study of stone artefacts is a fundamental concern of prehistoric archaeology, reflecting the bias of the archaeological record towards these least destructible elements of past cultural systems. Traditionally under the culture history paradigm, research on stone artefacts focused upon the elucidation of temporal and spatial dimensions of static morpho-functional types. Over the last two decades however, increasing attention has been directed towards technological aspects of artefact manufacture, resulting in the recognition of stone artefacts as dynamic elements of cultural systems. At the heart of this paradigmatic redirection has been studies documenting changes in artefact morphology resulting from rejuvenation of worn or broken tools (Frison, 1968; Wheat, 1975; Cahen, Keeley and van Noten, 1979; van Noten, Cahen and Keeley, 1980; Dibble, 1984, 1987; Driskell, 1986; Hiscock, 1988a; Flenniken and Raymond, 1986).

Australian archaeologists have long recognised the effects of resharpening upon stone artefact morphology, particularly in the case of the gradual reduction of tula adzes into exhausted tula slugs (Howchin, 1934; Mulvaney, 1975; McCarthy, 1976; Sheridan, 1979). The tula adze reduction model however, is largely derived from ethnographic observations of hafted tula adze resharpening (Horne and Aiston, 1924; Tindale, 1965; Gould, Koster and Sontz, 1971). Few studies have demonstrated directly from the archaeological record that prehistoric tulas were reduced to exhausted tula slugs by gradual resharpening of blunted working edges (Gould, 1977; Hiscock, 1988b; Hiscock and Veth, 1991).

The only Australian study specifically aimed at demonstrating tool resharpening from the archaeological record is Kamminga's (1974) analysis of 'unifacial pebble choppers' from the Seelands site in northeastern New South Wales (McBryde, 1974). It was found that the extensive use-wear on many of these tools was similar to truncated segments of use-wear found on a number of small flakes also recovered from the site. As a result, Kamminga concluded that since:

'...the flakes are found in association with the unifacial pebble choppers at Seelands, and since the morphology and distribution of the wear along the edges is the same on both artefact types, it is almost certain that the polished rejuvenation flakes are the retouch debitage from the unifacial pebble choppers '(1974, p. 371).

Although Kamminga's (1974) report was only preliminary, it does provide an analytical framework for investigation of stone tool resharpening. Of particular significance is the identification of similar use-wear patterns on both tools and resharpening flakes. My paper attempts to elaborate Kamminga's approach through an examination of bevel-edged tool resharpening from coastal southeast Queensland.

PREVIOUS RESEARCH ON BEVEL-EDGED TOOLS

Jackson (1939) described stone artefacts he surface collected from shell middens on the Sunshine Coast, southeast Queensland (Fig. 1).

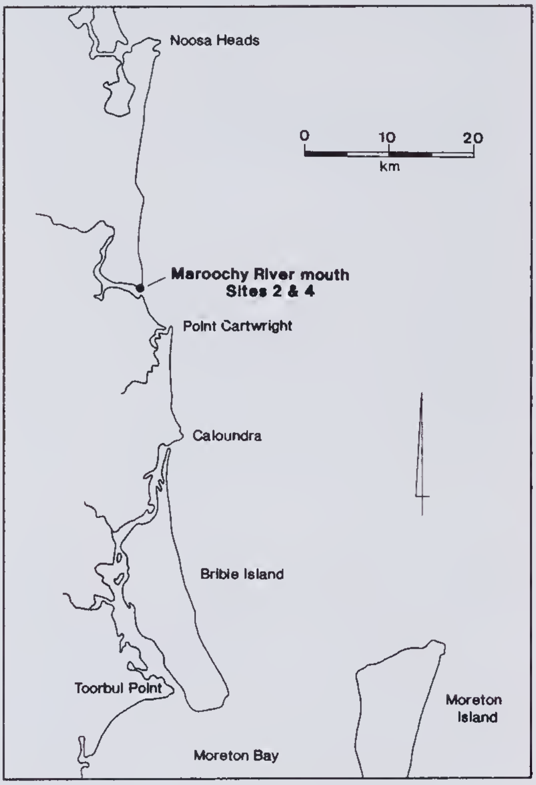

FIG. 1. Map of study area.

Amongst these artefacts were implements he associated with the processing of starch-rich rhizomes of 'bungwall' fern (*Blechnum indicum*). Classing these artefacts *bungwall choppers*, Jackson described them as being 'quartzite or some other suitable rock, flaked away on one margin after the style of a chisel, and possessing secondary chipping along its edge' (Jackson, 1939, p. 292). Jackson's functional inference appears to have been based upon early European observations of fern root processing by coastal Aboriginal people in the region, the morpho-functional potential of the implements and the identification of edge 'rounding' on some 'cutting edge(s)' (Jackson, 1939, p. 290–293).

In the 1970's Kamminga (1981) examined eleven artefacts from various locations in coastal southeast Queensland within the category of 'bungwall choppers' and identified a separate tool type called *bevelled pounders*. This new category was based on use-wear patterns, and was restricted to implements exhibiting intentionally ground flat bevels on their edges, some 3-13mm in width (Kamminga, 1981, p. 34). The remaining 'chopper' implements were identified as *worimi* (McCarthy, 1941, p. 24; 1976, p. 25; McCarthy, Bramell and Noone, 1946, p. 22) or more generally *east coast chopping tools* (Kamminga, 1978, p. 270–273), a separate class of implement exhibiting edge 'rounding' as opposed to edge bevelling. Using both ethnohistorical observations (e.g. Bancroft, 1894; Petrie, 1980) and the results of his own use-wear analyses, Kamminga (1981) associated bevelled pounders with the processing of bungwall fern root. In contrast, the wear on the choppers was consistent with 'woodworking activities' (Kamminga,1981, p.34).

A subsequent morphological and selective use-wear analysis of 24 bevelled pounders from the Toorbul Point area adjacent to Bribie Island was undertaken by Gillieson and Hall (1982). Once again, the tools were associated with the processing of bungwall fern. Other results relevant to this study were, first, bevels tend to be quite narrow, with the majority (72%) less than 3mm in width. Second, bevelling can result from use-wear rather than purposeful grinding. Third, use-wear patterns indicate that the use of these tools also included chopping and scraping activities, not just pounding. As a result, the functional categorization of these implements as bevelled pounders was questioned. Although the term bevelled pounder has continued to be used in recent years (McNiven, 1985; Nolan, 1986; Hall and Hiscock, 1988; Hall, Higgins and Fullagar, 1989), this study will employ the more functionally neutral label of *bevel-edged tool.*

Bevel Resharpening

The chopping and scraping procedure employed by Gillieson and Hall (1982) in their experimental use-wear study was based upon descriptions by Bancroft (1894) and Petrie (1980) of bungwall processing by Moreton Bay Aboriginal people during the 19th century. For example, Bancroft (1894, p. 25) suggested 'The bungwall stone is not unlike a stone tomahawk, the sharp edge being used to bruise the rhizome against a slab of bloodwood', while Petrie (1980, p. 92) stated that the fern was 'scraped and cut up finely with sharp stones on a log' (see Fig. 2). Gillieson and Hall (1982, p. 59) found that removal of starchy material from the central part of the rhizome was 'facilitated' by the use of 'sharp-edged' implements, a finding consistent with the narrow bevels found on most archaeological specimens of bevel-edged tools.

Hall, Higgins and Fullagar (1989, p. 150) sug-

FIG. 2. Photo of Aboriginal man processing bungwall fern on Bribie Island circa 1890 (Queensland Museum Neg.# LH285/20a).

gested that as the relative efficacy of bevel-edged tools to process plant foods gradually decreased with progressive bevel widening from continued use, a series of resharpening flakes may have been removed to rejuvenate the bevelled working edge. This suggestion appears to derive from the observation of flaking along some bevelled margins, which in some cases has removed large sections of the actual bevel (cf. Crooks, 1982, p. 86). To date however, no attempt has been made to demonstrate whether bevel flaking actually represents bevel rejuvenation (i.e. resharpening) and/or some other form of artefact modification.

MAROOCHY RIVER MOUTH SITES

Maroochy River mouth Sites 2 and 4 exhibit a range of shell and stone artefact remains, including bevel-edged tools, dating to the last 500 years (McNiven, 1989) (Fig. 1). They are located on low sand ridges (1–2m a.s.l.) in an area of seasonally inundated sedgeland swamps and tidal mangrove forests. Vegetation on the sites includes mixed eucalypt forest and casuarina woodlands.

The bevel-edged tools analysed in this paper were from a series of surface excavations totalling some 184 m^2 in area (see McNiven, 1989 for details). During preliminary analysis of all stone artefacts from both sites however, I noticed that many small flakes exhibited remnants of bevelled edges similar to the resharpening flakes described by Kamminga (1974) for the Seelands site. As a result, I decided that the sample of bevel-edged artefacts from Sites 2 and 4 would provide an excellent opportunity for the investigation of bevel-edged tool resharpening.

Bevel-edged Stone Artefacts

Stone artefacts were classified as bevel-edged artefacts if they possessed one or more bevelled edges. A bevelled edge was defined as any edge with a flat facet exhibiting use-wear. Use-wear was identified by the presence of abrasive smoothing and/or impact cracking on the bevelled surface and edge rounding along the margins of the bevel. This definition allowed differentiation from edges modified by rounding (e.g. east coast chopping tools) and/or percussion flaking (Kamminga,1981, p.17). All bevelled edges were examined using a Wild steroscopic microscope with a zoom lens (12–60x magnification).

The 107 bevel-edged artefacts recovered from Sites 2 and 4, were broadly classified as 42 flakes, 35 cores, 21 broken flakes (missing initiation platform) and flaked pieces and 9 manuports after Hiscock's (1984, p. 129) stone artefact fracture typology. For the purposes of this paper however, analysis was restricted to cores and flakes (n=77, 72%). Both these artefact types allowed more direct and precise inferences to be made concerning the manufacture and reduction of bevel-edged tools. In contrast, technological insights into the production of broken flakes and flaked pieces were limited by a lack of diagnostic flaking traits, while manuports, by definition, exhibit no evidence of flaking.

Cores

The 35 bevelled cores are represented by at least eight stone types with the majority (n=23, 66%) manufactured from arkose (feldspathic sandstone) and silcrete (Table 1). Artefact weights range from 33.4g to 1112.0g with a mean of 347.1g (Table 1). The majority (n=32) of cores exhibit areas of cortex, most of which

TABLE 1: Bevel-edged artefact raw materials

Raw material	Cores n	Cores %	Cores wt.(g)	Cores %	Flakes n	Flakes %	Flakes wt.(g)	Flakes %
Arkose	12	34.3	4092.0	33.6	29	69.0	1080.2	75.8
Sandstone	2	5.7	571.7	4.7	0	0.0	0.0	0.0
Silcrete	11	31.4	2760.0	22.7	7	16.7	314.3	22.0
Quartz	2	5.7	1250.5	10.3	1	2.4	2.8	0.2
Quartzite	1	2.9	207.4	1.7	0	0.0	0.0	0.0
Trachyte	1	2.9	595.7	4.9	0	0.0	0.0	0.0
Rhyolite	1	2.9	343.9	2.8	0	0.0	0.0	0.0
Igneous*	5	14.3	2349.3	19.3	5	11.9	28.7	2.0
Totals:	35	100	12170.5	100	42	100	1426.0	100

* = unidentified igneous rock

indicate the exploitation of river cobbles (n=31) (e.g. Fig. 3a).

The length of a bevel was defined by the maximum extent of continuous or discontinuous bevelling along a single edge. The mean length of a bevelled edge is 32mm with a range of 6-110mm. In contrast, maximum bevel widths have a much more restricted range of 1–18mm with a mean of 5mm (Table 2). The number of bevels on cores ranges from 1–5 with a mean of 2.6.

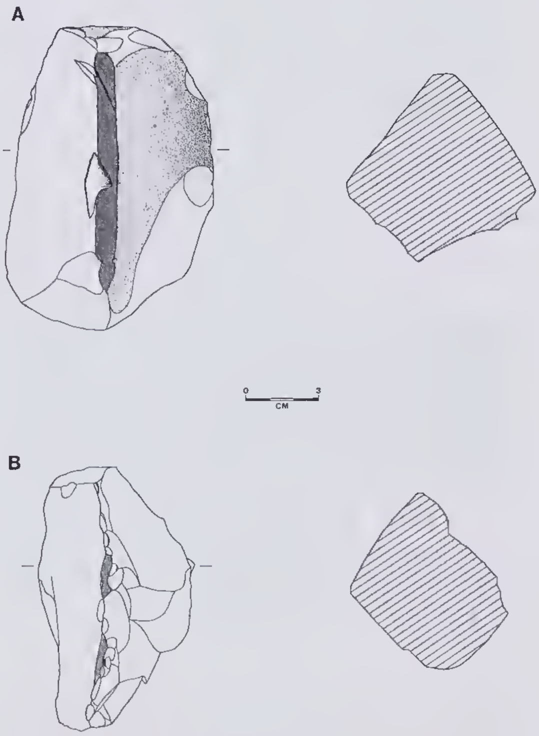

FIG. 3. Bevel-edged tools from Maroochy River mouth Site 4: A, bevelled core (SQ25); B, bevelled flake (SQ13) (bevels denoted by grey shading).

Most bevelled edges (n=59, 64%) exhibit some form of flaking modification. In some cases, flaking was initiated from the working edge using the bevelled surface as a striking platform. This activity resulted in the removal of a *marginal* section of bevel producing a localized reduction in bevel width (Figs 3a, 4a). In other cases, flaking was initiated immediately to the side of the bevelled edge using one of the lateral faces as a striking platform. The result was the removal of an entire *segment* of bevel thus producing a discontinuity in the bevelled edge (Fig. 4b, see also Fig. 3b).

FLAKES

The 42 bevel-edged flakes were classified into the broad categories of either bevelled flakes (n=5) or bevel flakes (n=37). *Bevelled flakes* exhibit bevelling along the edge of the ventral or inside surface, indicating that the bevel was created after the flake was created (Fig. 3b). In contrast, *bevel flakes* exhibit bevels located on the dorsal or outside surface and/or platform with no encroachment onto the ventral surface. In all cases where bevels intersect the margin of the flake, the bevel has been truncated by the

TABLE 2: Bevel-edged artefact bevel characteristics

	Bevelled cores	Bevelled flakes	Type A	Bevel flakes Type B	Type C
Number of artefacts	35	5	21	11	5
Number of bevels	92	10	24	11	5
Bevel length (mm)					
minimum	6	7	4	3	7
maximum	110	37		25	15 32
mean	32.2	25.8	15.1	8.1	—
Bevel width (mm)					
minimum	1	1	2	1	2
maximum	18	7	6	3	6
mean	5.2	3.6	4.0	1.9	—

NB. means calculated only for sample sizes of 10 or more

ventral surface, indicating that the bevel was created prior to flake detachment.

Bevel flakes were further subdivided into three types (Table 2). Type A bevel flakes (n=21) exhibit a single truncated segment of a bevelled edge located along the dorsal edge of the platform (Fig. 5) and were produced by the process of segment bevel flaking (Fig. 4b). Three of these flakes also exhibit small segments of a bevelled edge located on the distal half of the dorsal surface (Fig. 5d). Type B bevel flakes (n=11) have a platform consisting of the marginal section of a bevelled edge with the actual edge of the bevel forming the dorsal edge of the platform (Fig. 6). They were produced as a result of marginal bevel flaking (Fig. 4a). Type C bevel flakes (n=5) exhibit either a truncated segment or a marginal section of a bevelled edge running along a dorsal ridge oriented sub-parallel to the lateral margins of the flake (Fig. 7).

Bevel-edged flakes are made from at least four stone types with the majority represented by arkose and silcrete (n=36, 86%) (Table 1). Flake weights range from 0.1g to 595.6g with a mean of 34.0g.

Testing the Resharpening Hypothesis

The patterning of bevelling on bevelled cores and bevelled flakes demonstrates that these artefacts were used as *tools*. That is, the artefacts were actually used to perform some activity that created a bevelled edge. In contrast, the truncation of most bevelled edges on bevel flakes by dorsal negative flake scars and/or by the ventral surface indicates that the bevels on these artefacts was created prior to detachment from a bevel-edged tool (i.e. bevelled core or bevelled flake).

Most bevel flakes exhibit bevels located either along the dorsal edge of the platform (Type A) or on the actual platform itself (Type B) (n=32, 86%). These flakes would have resulted in localized, relative increases in working edge sharpness, raising the question as to whether such edge resharpening was the reason for the removal of these bevel flakes.

Intentional Flaking or Use-wear?

Implicit in the concept of resharpening is the notion of a conscious and deliberately planned course of action. Therefore, all identified resharpening flakes must be demonstrated to be the result of intentional removal by knappers.

The problem of intentional flaking is not as simple as it may appear. Numerous bevel-edged tools have a series of cracks running through the surface of the bevel sub-parallel to the bevel margin. These cracks result from multiple im-

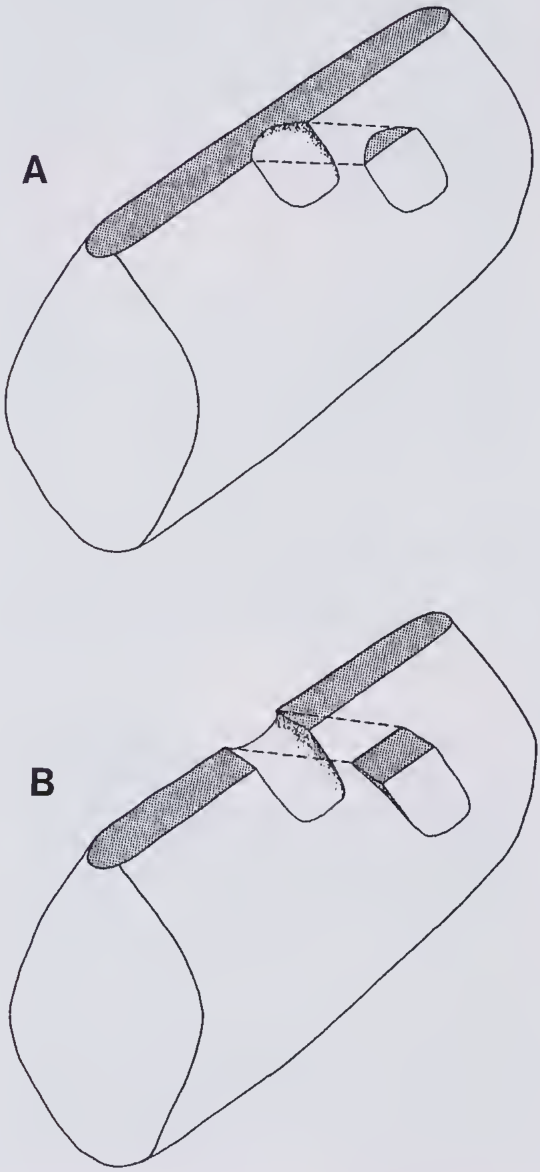

FIG. 4. Bevel flaking types: A, marginal bevel flaking; B, segment bevel flaking.

pacts of the bevelled edge against a relatively hard surface during use. In other cases, these cracks have continued through the artefact and intersected the lateral face of the bevelled edge forming a fracture and a partially detached flake (Fig. 8). It is apparent that if force had continued to be applied to these partly detached flakes, most would have been dislodged removing a marginal section of bevel on the flake platform.

The morphology of these partially detached flakes is identical to Type B bevel flakes documented above. Such an observation provides support for the hypothesis that Type B bevel flakes are in fact a use-wear phenomenon and not the result of intentional knapping (cf. "impact flakes" - Hayden, 1979, p. 65).

It can be expected that if Type B bevel flakes are a use-wear phenomenon, then their relative abundance at the sites should reflect the relative scratch hardness and toughness of differing

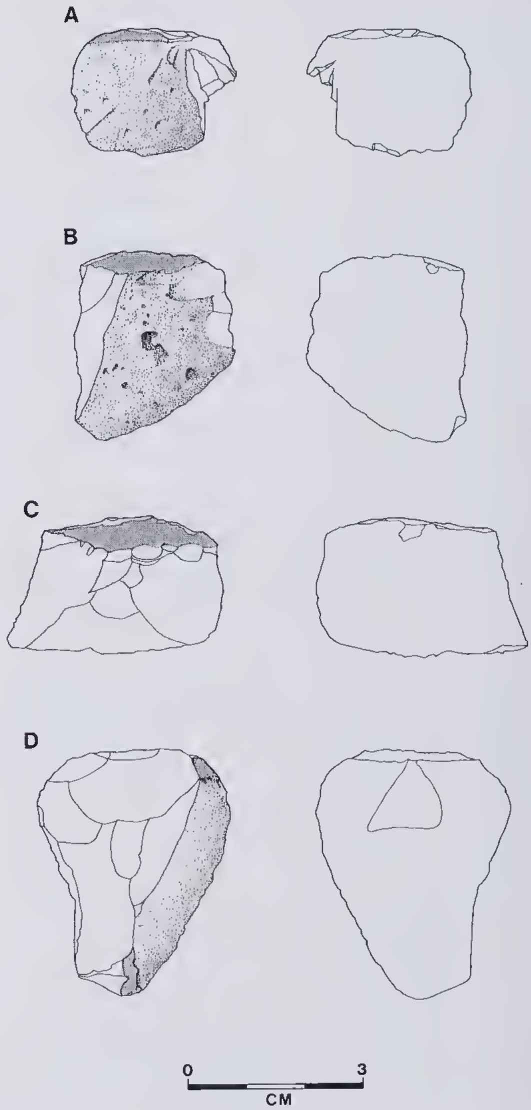

FIG. 5. Type A bevel flakes: A, Site 4/1/18; B, Site 4/1/25; C, Site 4/1/15; D, Site 4/1/8 (bevels denoted by dark shading).

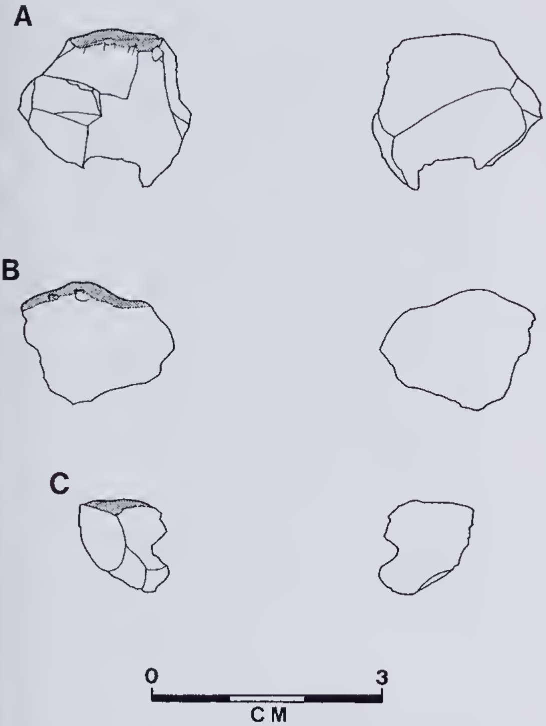

FIG. 6. Type B bevel flakes: A, Site 4/1/25; B, Site 4/1/7; C, Site 4/1/11 (bevels denoted by dark shading).

stone types from which bevel-edged tools are manufactured. As noted above, the majority of bevel-edged tools at these sites are manufactured from arkose and silcrete. Silcrete is the hardest (Mohs 8.5) and toughest (8.2 on the Modified Los Angeles Abrasion Test) stone generally used by Aboriginal people in Australia, making it the most resistant to use-wear abrasion and fracturing (Kamminga, 1982, p. 27–29). In contrast, arkose, which largely comprises feldspar grains (Prinz, Harlow and Peters, 1978), is some 30% softer (Mohs 6) (Hurlbut, 1959) than silcrete and much less tough (pers. obs.). As a result, the working edges of arkose bevel-edged tools would be less resistant to use-wear damage, and the archaeological record should exhibit a positive bias towards arkose Type B bevel flakes.

Fig. 9 shows that there is such a major bias. It should be noted however, that this finding does not negate the hypothesis that Type B bevel flakes are the result of bevel resharpening. For example, given that the working edges of arkose bevel-edged tools are more likely to wear faster than those on silcrete tools, it would be expected that arkose tools would require relatively greater

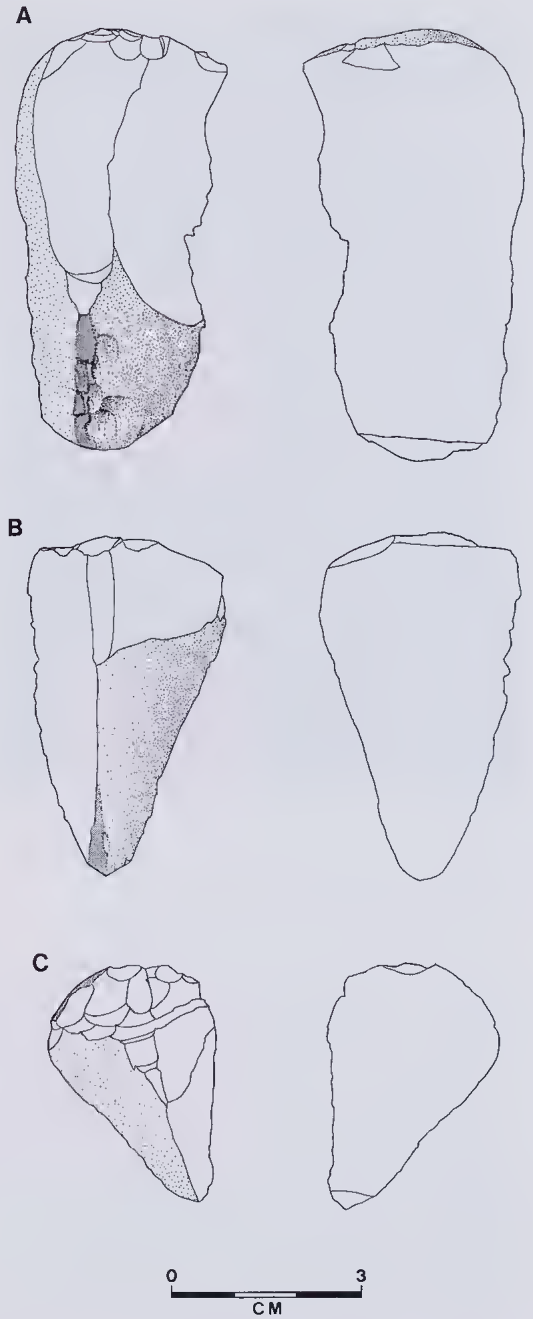

FIG.7. Type C bevel flakes: A, Site 2/12; B, Site 4/1/15; C, Site 4/1/18 (bevels denoted by grey shading).

edge rejuventation. However, when this data is combined with the crack and fracture data documented above, the overall evidence is more supportive of a use-wear origin for Type B bevel flakes.

FIG. 8. Photo of cracks along margins of bevel on a bevel-edged tool (Site 4/2/2) (x8).

The hypothesis that Type B bevel flakes are a use-wear phenomenon may also be complicated by differences in the use of silcrete and arkose bevel-edged tools. Examples include differential use of hardwood anvils, and differing tool functions, duration of tool use and amount of use prior to transportation and subsequent discard at sites. Despite these potential complications, the simplest explanation for the existence of Type B bevel flakes is impact of bevel-edged tools against a hard surface during use. This inference is consistent with ethnohistorical references documenting the use of 'bungwall stones' against a slab of hardwood (Fig. 2).

Edge Resharpening or Edge Reshaping?

The location of platforms away from the bevelled working edge on Type A and Type C bevel flakes suggests that these artefacts were a product of intentional knapping. Regarding bevel resharpening however, it is clear that the removal of Type A bevel flakes, in contrast to Type C bevel flakes, would have resulted in both a predictable and efficacious localized resharpening of the bevelled working edge.

It can be predicted that if flakes were systematically removed from more intensely use-worn (i.e. wider) bevels to resharpen the working edge, then the following two test implications would be expected. First, a high ratio of bevel "resharpening" flakes to bevel-edged tools on sites, and, second, bevels found on resharpening flakes should represent the larger end of the bevel width range found on bevel-edged tools.

The small ratio of Type A bevel flakes (n=21) to bevel-edged tools (n=40) recovered from Sites 2 and 4 contrasts with the expectations of the first resharpening test implication. The evidence shows that on average, less than one bevel "resharpening" flake exists for each bevel-edge tool discarded at both sites. When it is also considered that bevel-edged tools discarded on a site probably only represents a small proportion of the bevel-edged tools used at a site, it is clear that systematic resharpening of bevel-edged tools was not taking place at Sites 2 and 4. Similarly, it is doubtful that only an occasional resharpening flake was removed from a bevel-edge tool as such an isolated event would have little overall effect upon edge sharpness.

Following the second resharpening test implication, a comparison was made of bevel

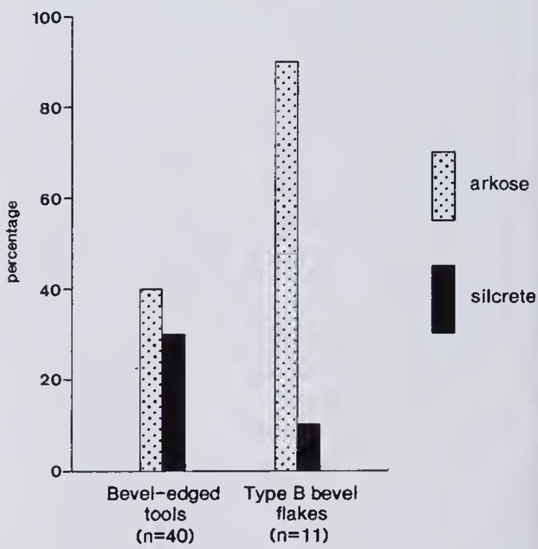

FIG. 9. Relative proportion of arkose and silcrete bevel-edged tools and Type B bevel flakes at Maroochy River mouth Sites 2 and 4.

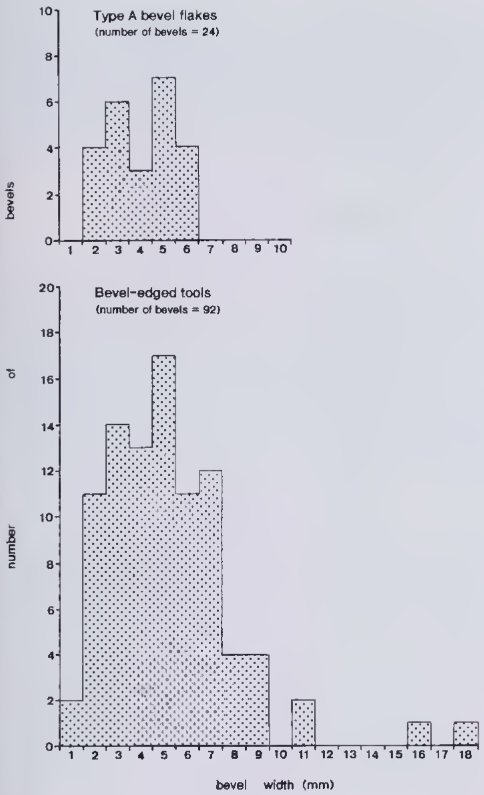

FIG 10. Distribution of bevel widths located on Type A bevel flakes and bevel-edged tools from Maroochy River mouth Sites 2 and 4.

widths on both Type A bevel flakes and bevel-edged tools. The width of bevels on Type A bevel flakes is remarkably representative of the lower half of the bevel width range recorded on bevel-edged tools (Fig.10). No apparent bias was observed for the removal of wider bevels from bevel-edged tools. In fact the smaller mean bevel width on Type A bevel flakes (4mm) compared to bevel-edged tools (5mm) supports the view that a bias existed towards the removal of flakes from narrower bevelled edges. Clearly, the hypothesis that bevel resharpening was taking place at Sites 2 and 4 is unsustainable.

The apparent targeting of narrower bevelled edges for flaking strongly supports the view that such modification was specifically related to a reshaping not resharpening of the working edge. Whether this reshaping was related to an actual change in tool function and/or the result of a localized rejuvenation of a damaged section of bevel is not known (Cahen, Keeley and van Noten, 1979, p. 666). Future resolution of this problem will centre upon a comparative use-wear study of variously sized bevels on both bevel flakes and bevel-edged tools, and the refitting of bevel flakes onto bevel-edged tools.

In contrast to Type A and Type B bevel flakes, the most parsimonious explanation for Type C bevel flakes is that they represent reduction of bevel-edged tools unrelated to the modification of the bevelled working edge they exhibit. In such a situation, it would be expected that a number of flakes would inadvertently exhibit remnants of old bevels along dorsal ridges sub-parallel to flake margins. Whether such reduction was actually aimed at increasing the general functional efficacy of the tool to perform similar and/or differing tasks is unknown.

REGIONAL VARIATIONS IN BEVEL RESHARPENING

The lack of supporting evidence for resharpening of bevel-edged tools at Maroochy River mouth Sites 2 and 4 does not negate the possibility that bevel resharpening occurred at other sites in the region. In this regard, future investigations of bevel-edged tool resharpening should consider regional variations in bevel-edged tool use and the effects of raw material proximity upon the nature of edge bevelling and edge maintenance.

For example, many archaeologists argue that regional variations in the form and modification of stone tools is a product of the nature of associated settlement-subsistence activities (Binford and Binford, 1966; Binford, 1973; 1977; 1979; Lourandos, 1977; McBryde, 1977; Ebert, 1979; Schrire, 1982; Torrence, 1983; Jones, 1985; Shott, 1986). Therefore, it is possible that bevel resharpening was only associated with certain types of activities, and that such activities were not carried out at Sites 2 and 4. Similarly, bevel resharpening may only occur after a prolonged period of tool use, at the end of a particular blunting stage in the use-life of a bevel-edged tool. If Maroochy River mouth Sites 2 and 4 were visited immediately after a resharpening stage, then little evidence of bevel resharpening would be expected (cf. Keeley, 1982, p. 807). In both situations, evidence for resharpening may be present at other sites in the region which form the remainder of the annual settlement-subsistence system.

The second potentially important issue concerning regional variations in bevel-edged tool resharpening is the effects of raw material proximity. Such influences may manifest themselves in two key areas. First, a corollary of the proposition that the physical properties of raw materials may influence the nature of bevel resharpening, is that any factor that influences the selection of raw materials for bevel-edged tools will also influence the potential nature of bevel resharpening. Of the numerous factors that influence peoples decisions concerning the selection of stone artefact raw materials, one of the most important is relative physical access to a stone source (Hayden, 1977; O'Connell, 1977; Byrne, 1980; Dibble, 1985; Hiscock, 1986; 1988a; McNiven in press). Consequently, bevel-edged tools located on sites in close proximity to a certain stone source would be expected to be manufactured mostly from this stone type. If this stone type was not very resistant to bevel use-wear damage, then a greater proportion of bevel resharpening flakes may be expected to occur on these sites.

The second potential effect of raw material proximity upon regional variations in bevel resharpening is relative costs of edge maintenance. For example, a negative relationship often exists between the relative amount of tool retouching on sites and the proximity of those sites to replacement stone. That is, as sites are located further away from a stone source, people are more inclined to rejuvenate (i.e. resharpen) the edges of tools made from that raw material as opposed to discarding the artefact (Schiffer, 1975; Hayden, 1977; Byrne, 1980; Bamforth, 1986; Hiscock, 1988a). It should be noted however, that the opposite effect may also take place. People may decide to increase the resharpening threshhold in situations where the cost of accessing replacement stone is energetically and/or socially higher than the cost of decreasing efficiency in tool function (Hiscock, 1988a, p. 113). Once again, both propositions can be tested by examining regional variations in the maintenance of bevelled edges on sites.

CONCLUSION

This paper has attempted to create an analytical framework for the investigation of bevel-edged tool resharpening in coastal southeast Queensland. It is hoped that this framework will not only aid future research in this area, but also stimulate researchers to explore other potential variables that may effect stone tool maintenance. Clearly, our ability to explore the dynamic use-life of stone artefacts within past cultural systems is limited by poorly developed theoretical models, and even more constrained by a lack of methodological tools operationalizing these models. In this regard, future study of the nature of bevel-edged tool resharpening may provide new insights into these important areas.

ACKNOWLEDGEMENTS

Preparation of this paper was aided by helpful comments provided by Jay Hall, Bruno David, Peter Hiscock, Jo Kamminga, Scott Mitchell and Eleanor Crosby. Kathy Frankland kindly assisted with the preparation of Fig. 2. Errors in fact or interpretation are solely my responsibility.

REFERENCES

BAMFORTH, D.B. 1986. Technological efficiency and tool curation. American Antiquity 51(1):38-50.

BANCROFT, T.L. 1894. Note on Bungwall (*Blechnum serrulatum* Rich.), an Aboriginal food. Proc. Linn. Soc. N.S.W. 19:25–26.

BINFORD, L.R. 1973. Interassemblage variability - the Mousterian and the 'functional' argument. 227–254. In C. Renfrew (ed.) 'The explanation of culture change'. (Duckworth: Surrey).

1977. Forty-seven trips: a case study in the archaeological formation processes. 24-36. In R.S.V. Wright (ed.) 'Stone tools as cultural markers: change, evolution and complexity'. (Australian Institute of Aboriginal Studies: Canberra).

1979. Organization and formation processes: looking at curated technologies. J. Anthropological Res. 35(3):255–273.

BINFORD, L.R. AND BINFORD, S.R. 1966. A preliminary analysis of functional variability in the Mousterian of Levallois facies. American Anthropologist 68(20):238–295.

BYRNE, D. 1980. Dynamics of dispersion: the place of silcrete in archaeological assemblages from the lower Murchison, Western Australia. Archaeology and Physical Anthropology in Oceania 15:110–119.

CAHEN, D., L.H. KEELEY AND F.L. VAN NOTEN 1979. Stone tools, toolkits, and human behaviour in prehistory. Current Anthropology 20(4):661–683.

CROOKS, J. 1982. Report of three excavations at Pumicestone Passage, Moreton Bay, southeast Queensland. Unpublished B.A. (hons) thesis, University of Queensland.

DIBBLE, H.L. 1984. Interpreting typological variation of Middle Paleolithic scrapers: function, style, or sequence of reduction? J.Field Archaeol. 11:431–436.

1985. Raw-material variation in Levallois flake manufacture. Current Anthropology 26(3):391–393.

1987. The interpretation of Middle Paleolithic scraper morphology. American Antiquity 52(1):109–117.

DRISKELL, B.N. 1986. The chipped stone tool production/use cycle. BAR International Series 305.

EBERT, J.I. 1979. An ethnoarchaeological approach to reassessing the meaning of variability in stone tool assemblages. 59–74. In C. Krammer (ed.) 'Ethno-archaeology: implications of ethnography for archaeology'. (Columbia University Press: New York).

FLENNIKEN, J.J. AND RAYMOND, A.W. 1986. Morphological projectile point typology: replication experimentation and technological analysis. American Antiquity 51(3):603–614.

FRISON, G.C. 1968. A functional analysis of certain chipped stone tools. American Antiquity 33(2):149–155.

GILLIESON, D.S. AND HALL, J. 1982. Bevelling bungwall bashers: a use-wear study from southeast Queensland. Australian Archaeology 14:43–61.

GOULD, R.A. 1977. Puntutjarpa Rockshelter and the Australian Desert Culture. Anthrop. Paps Amer. Mus. Nat. Hist. 54(1).

GOULD, R.A., KOSTER, D.A. AND SONTZ, A.H.L. 1971. The lithic assemblage of the Western Desert Aborigines of Australia. American Antiquity 36(2):149–169.

HALL, J., HIGGINS, S. AND FULLAGAR, R. 1989. Plant residues on stone tools. 136–160.In W. Beck, Clarke, A. and Head, L. (eds.) 'Plants and Australian archaeology'. Tempus Volume I.

HALL, J. AND HISCOCK, P. 1988. The Moreton Region Archaeological Project (MRAP) - Stage II: an outline of objectives and methods. Qd Archaeol. Res. 5:4–24.

HAYDEN, B. 1977. Stone tool functions in the Western Desert. 178–188. In R.S.V. Wright (ed.) 'Stone tools as cultural markers: change, evolution and complexity'. (Australian Institute of Aboriginal Studies: Canberra).

1979. Palaeolithic reflections: lithic technology and ethnographic excavation among Australian Aborigines. (Australian Institute of Aboriginal Studies: Canberra).

HISCOCK, P. 1984. Preliminary report on the stone artefacts from Colless Creek Cave, northwest Queensland. Qd Archaeol. Res. 1:120–151.

1986. Raw material rationing as an explanation of assemblage differences: a case study from Lawn Hill, northwest Queensland. 179–190. In G. K. Ward (ed.) 'Archaeology at Anzaas Canberra: a collection of papers presented to Section 25A, of the Congress of the Australian and New Zealand Association for the Advancement of Science, in May 1984'. (Canberra Archaeological Society:Canberra).

1988a. Prehistoric settlement patterns and artefact manufacture at Lawn Hill, North-west Queensland. Unpublished Ph.D. thesis, University of Queensland.

1988b. A cache of tulas from the Boulia district, western Queensland. Archaeology in Oceania 23(2): 60–70.

HISCOCK, P. AND VETH, P. 1991. Change in the Australian Desert Culture: a re-analysis of tulas from Puntutjarpa Rockshelter. World Archaeology 22(3): 332–345.

HORNE, G.A. AND AISTON, G. 1924. 'Savage life in central Australia'. (MacMillan:London).

HOWCHIN, W. 1934. Stone implements of the Adelaide tribe of Aborigines now extinct. Adelaide.

HURLBUT, C.S. 1959. 'Dana's manual of mineralogy'. (John Wiley and Sons:New York).

JACKSON, G.K. 1939. Aboriginal middens of the Point Cartwright district. Mem. Qd Mus. 2:289–295.

JELINEK, A.J. 1976. Form, function and style in lithic analysis. 19–33. In C.B. Cleland (ed.) 'Cultural change and continuity'. (Academic Press:New York).

JONES, R. (ed.) 1985. Archaeological research in Kakadu National park. ANPWS Publ. 13. (ANU: Canberra).

KAMMINGA, J. 1974. Appendix 2 (7) Report on the edge wear on stone tools from the Clarence River sites. 371–372. In I. McBryde 'Aboriginal prehistory in New England'. (Univ.Sydney Press:Sydney).

1978. Journey into the microcosms: a functional analysis of certain classes of prehistoric Australian stone tools. Unpublished Ph.D thesis, University of Sydney.

1981. The bevelled pounder: an Aboriginal stone tool type from Southeast Queensland. Proc. R. Soc. Qd 92:31–35.

1982. Over the edge: functional analysis of Australian stone tools. Univ. Qd Anthrop. Mus. Occas. Paps Anthrop. 12.

KEELEY, L.H. 1982. Hafting and retooling: effects on the archaeological record. American Antiquity 47(4):798–809.

LOURANDOS, H. 1977. Stone tools, settlement, adaptation: a Tasmanian example. 219–224. In R.S.V. Wright (ed.) 'Stone tools as cultural markers: change, evolution and complexity'. (Australian Institute of Aboriginal Studies:Canberra).

MCBRYDE, I. 1974. 'Aboriginal prehistory in New England'. (Univ. Sydney Press:Sydney).

1977. Determinants of assemblage variation in New England prehistory. 225–250. In R.S.V. Wright (ed.) 'Stone tools as cultural markers: change, evolution and complexity'. (Australian Institute of Aboriginal Studies:Canberra).

MCCARTHY, F. D. 1941. Two pebble industry sites of Hoabinhien 1 type on the north coast of New South Wales. Rec. Aust. Mus. 21(1):21–26.

1976. Australian Aboriginal stone implements. (Australian Museum Trust: Sydney).

MCCARTHY, F.D., BRAMELL, E. AND NOONE, H.V.V. 1946. The stone implements of Australia. Mem. Aust. Mus. 9.

MCNIVEN, I. 1985. An archaeological survey of the Cooloola region, S.E. Queensland. Qld Archaeol. Res. 2:4–37.

1989. Aboriginal shell middens at the mouth of the Maroochy River, Southeast Queensland. Qd Archaeol. Res. 6:28–52.

in press. The effects of raw material proximity upon stone artefact assemblages along the Cooloola coastline, S.E. Queensland. In I. Davidson, Godwin, L. and Sutton, S. (ed.) 'Technological analysis and Australian archaeology'. BAR International Series.

MULVANEY, D.J. 1975. 'The prehistory of Australia'. (Pelican: Melbourne).

NOLAN, A. 1986. Sandstone Point: temporal and spatial patterns of Aboriginal site use at a midden complex, southeast Queensland. Unpublished B.A. (hons) thesis, University of Queensland.

O'CONNELL, J.F. 1977. Aspects of variation in central Australian lithic assemblages. 269–281. In R.S.V. Wright (ed.) 'Stone tools as cultural markers: change, evolution and complexity'. (Australian Institute of Aboriginal Studies:Canberra).

PETRIE, C.C. 1980. 'Tom Petrie's reminiscences of early Queensland'. (Angas and Robertson:Brisbane).

PRINZ, M., HARLOW, G. AND PETERS, J. 1978. 'Simon and Schuster's guide to rocks and minerals'. (Fireside:New York).

SCHIFFER, M.B. 1975. Classifications of chipped-stone tools. In M.B. Schiffer and House, J.H. (eds) 'The Cache River archeological project: an experiment in contract archeology'. Arkansas Archaeological Survey, Res. Ser. 8.

SCHRIRE, C. 1982. The Alligator rivers: prehistory and ecology in western Arnhem Land. Terra Australis 7. (ANU Press: Canberra).

SHERIDAN, G. 1979. Tulas and triodia: a multidisciplinary investigation of the mechanics and antecedents of the Koondi Tuhla and their implications for prehistory. Unpublished B.A. (hons) thesis, Australian National University.

SHOTT, M. 1986. Technological organization and settlement mobility: an ethnographic examination. J. Anthrop. Res. 42:15–51.

TINDALE, N.B. 1965. Stone implement making among the Nakako, Ngadadjara and Pitjandjara of the Great Western Desert. Rec. S. Aust.. Mus. 15:131–164.

TORRENCE, R. 1983. Time budgeting and hunter-gatherer technology. 11–22. In G. Bailey (ed.) 'Hunter-gatherer economy in prehistory'. (Cambridge University Press: Cambridge).

VAN NOTEN, F., CAHEN, D. AND KEELEY, L. 1980. A Paleolithic campsite in Belguim. Scientific American 242(4):44–51.

WHEAT, J.B. 1975. Artefact life histories: cultural templates, typology, evidence and inference. 7–15. In J.S. Raymond, Loveseth, B., Arnold, C. and Reardon, G. (eds). 'Primitive art and technology'. Archaeol. Ass., Dept. Archaeol., Univ. Calgary.